Fermi National Accelerator Laboratory

TM-622
0526

MAGNET MEASUREMENT ON 56-INCH EXTRACTION QUAD

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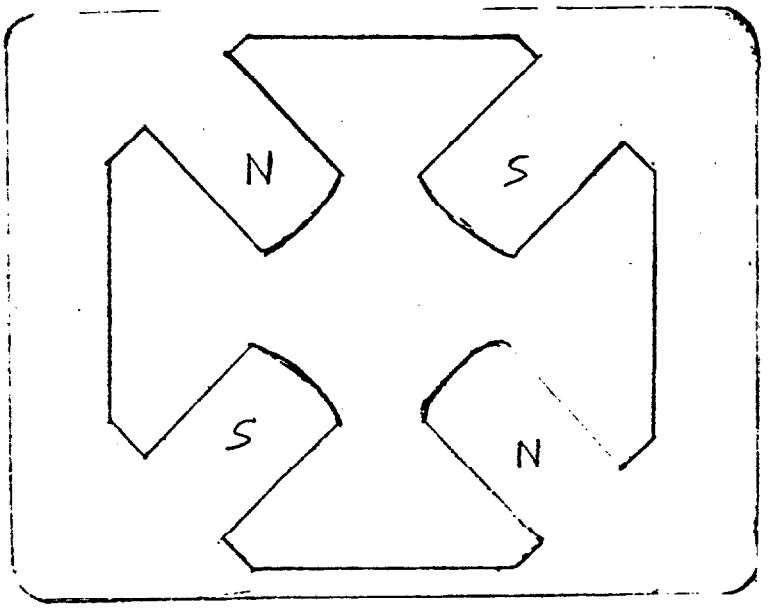
The following data is Hall probe data of the B vs I curve and a field versus position curve. The B versus I curve was taken with a small 22.5 kW Acme power supply used in a DC current mode. For excitation curve, a F.W. Bell 811 AR gaussmeter was used with a 0.1% probe at x = 1.0". The B field data is listed in Table I and the corresponding graph is Figure I.

The field versus position curve was taken with the same equipment and methods used in the B versus I curve. A horizontal lathe was used to move the probe across the gap from +1.3" to -1.3". The field versus position data was taken at 50 Amps and 100 Amps DC. The data is listed in Table II, and was truncated to the accuracy of the measurement. Figure II is the corresponding graph.

A gradient was calculated from the Table II of real data. The grade from x = ±1.0" was used for the $G_{(o)}$ and per cent change from the $G_{(o)}$ grade was calculated and graphed for Table III and Figure III. Although the measurement is not accurate, the data shows 3 to 4% drop in gradient at ±1.0". This may be due to mechanical inaccuracy of assembly. Stretched wire method was not used.



Parameter List of 56" Extraction Quadrupole Magnet

Magnet Length	56"
Magnet Width	17"
Magnet Height	13"
Wire Size	#1 wire
Turns	46 turns/Pole
Water Cooling Fin	Potted Inside
Bore	2.997"
Field Gradient	1.975 KG/in @ 100A
R(dc)	0.1897Ω
L_s @ 1 KHz	61.0 mH
Q @ 1 KHz	2.17
L_s at 50 Hz	100 mH
Q at 50 Hz	8.15

Magnet Field Data on 56" Extraction Quad

Table I

B vs I

x = +1.0"

current I = amps	field B = kG
10 A	.198 kG
20 A	.392 kG
30 A	.587 kG
40 A	.783 kG
50 A	.978 kG
60 A	1.174 kG
70 A	1.369 kG
80 A	1.564 kG
90 A	1.758 kG
100 A	1.953 kG

Table II

Field vs Position

Z = 10" in from end plate

position inches	I = 50 A field B = kG	I = 100 A field B = kG
-1.3 in	-1.27 kG	-2.52 kG
-1.2	-1.17	-2.34
-1.1	-1.08	-2.15
-1.0	- .98	-1.96
- .9	- .89	-1.77
- .8	- .79	-1.58
- .7	- .69	-1.39
- .6	- .60	-1.19
- .5	- .50	-1.00
- .4	- .40	- .81
- .3	- .30	- .61
- .2	- .21	- .41
- .1	- .11	- .22
0	- .01	- .02
.1	.09	.18
.2	.19	.37
.3	.29	.57
.4	.39	.76
.5	.48	.96
.6	.58	1.16
.7	.68	1.35
.8	.77	1.55
.9	.87	1.74
1.0	.97	1.93
1.1	1.07	2.12
1.2	1.16	2.31
1.3	1.26	2.51

Gradient on 56" Extraction Quad

Table III

$$G_o = \frac{B_{(x=+1.0")} - B_{(x=-1.0")}}{2}$$

$$\text{Per Cent Change} = \left[\frac{k[B_{(nx)} - B_{(nx-1)}] - G_o}{G_o} \right] \times 100, \quad k = \frac{x}{\Delta x} = \frac{1.0"}{.1"}$$

Current Inches	50 Amps Per Cent	100 Amps Per Cent
-1.3	-3.7	-4.2
-1.2	-2.5	-3.7
-1.1	-2.4	-2.9
-1.0	-2.2	-2.6
- .9	- .9	-1.7
- .8	-1.5	-1.5
- .7	- .8	- .5
- .6	-1.0	- .7
- .5	.4	0
- .4	.2	.9
- .3	.5	.9
- .2	.8	.5
- .1	.4	1.3
0	1.1	1.5
.1	1.8	1.6
.2	.2	.6
.3	1.4	.4
.4	.7	.7
.5	1.2	.7
.6	.8	- 0
.7	.2	+1.0
.8	.3	- .2
.9	.2	- .4
1.0	.7	-1.1
1.1	-3.3	-1.0
1.2	-5.0	-1.6
1.3		-1.2

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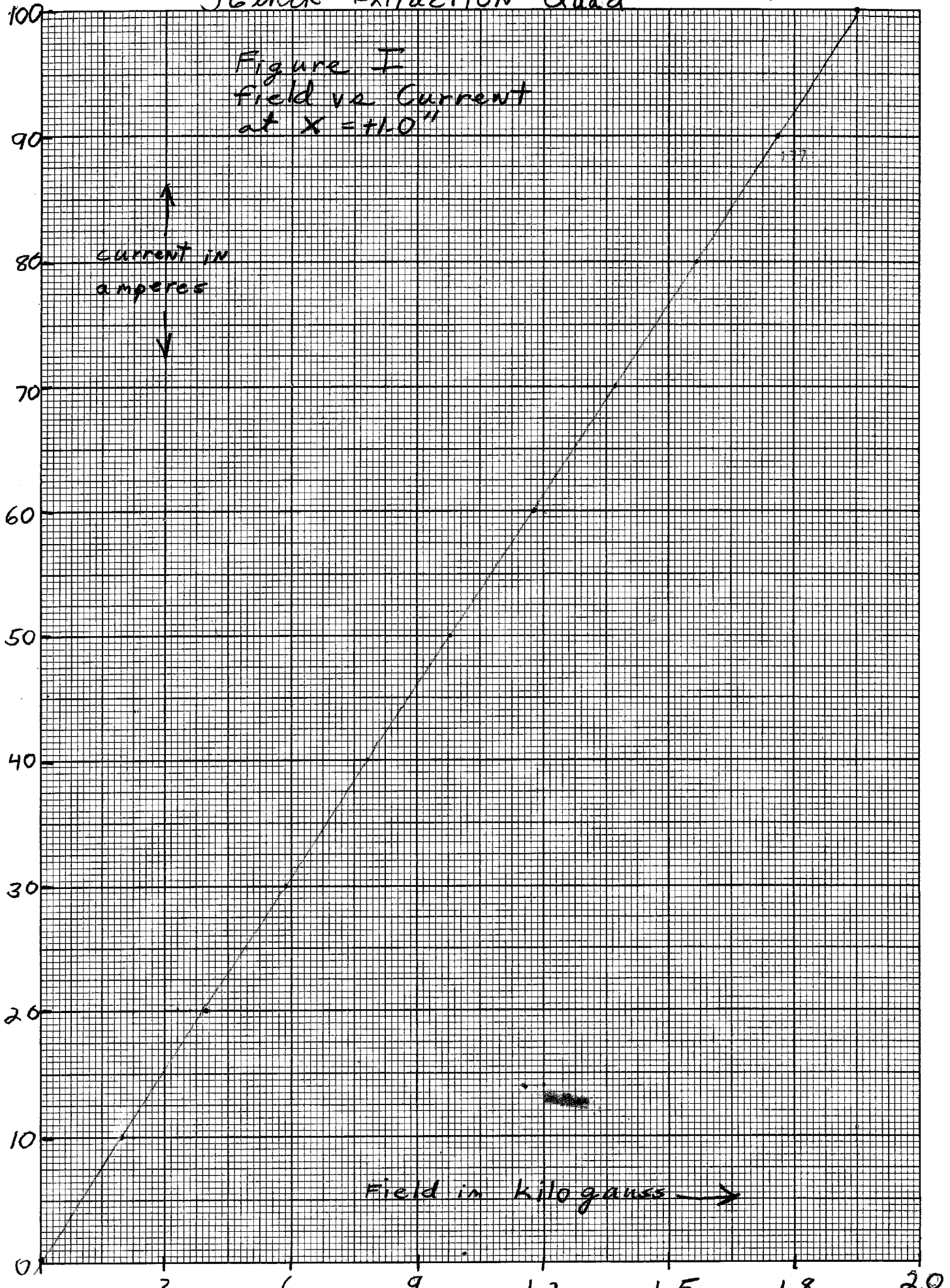
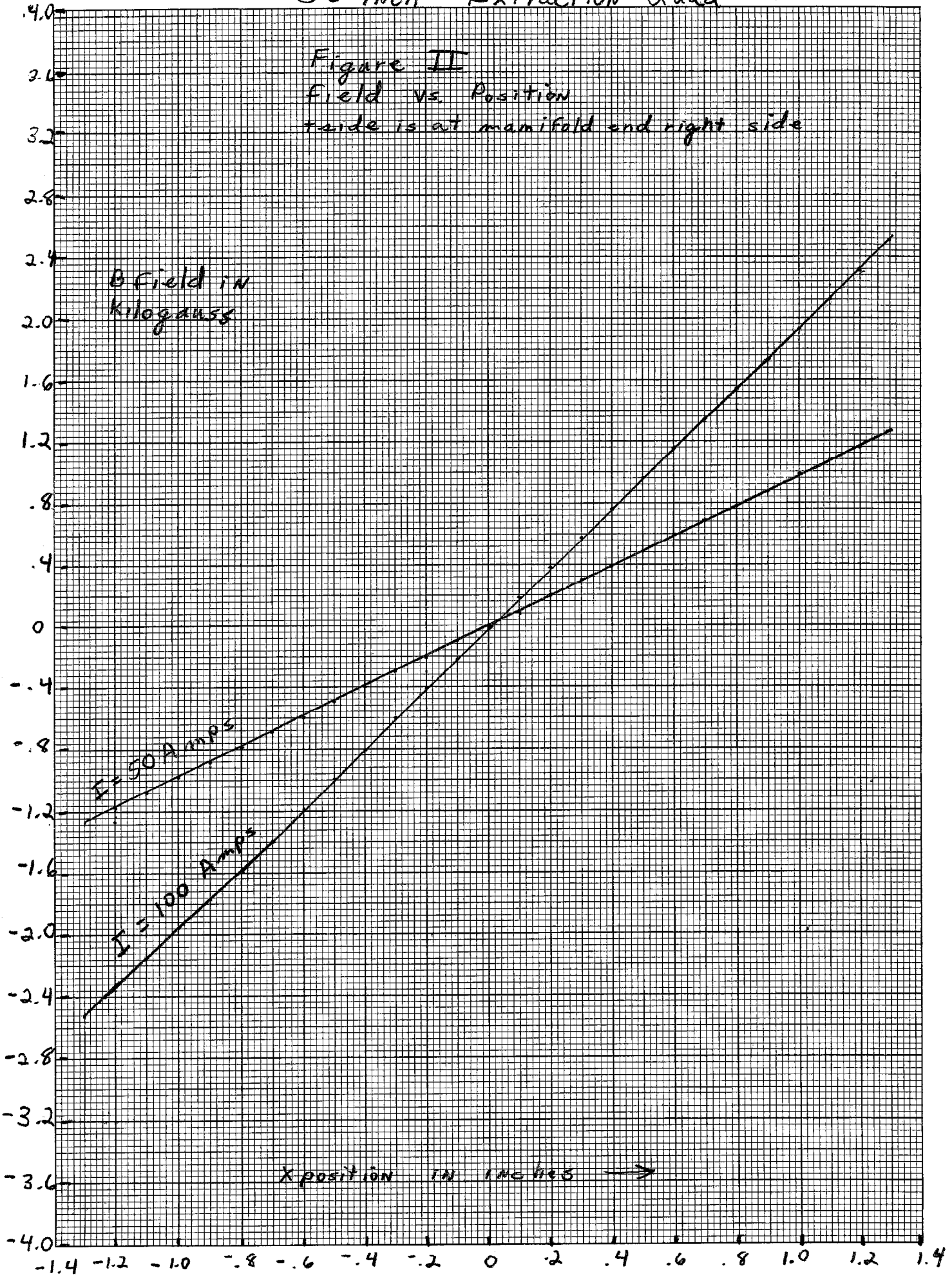
56 inch Extraction Quad

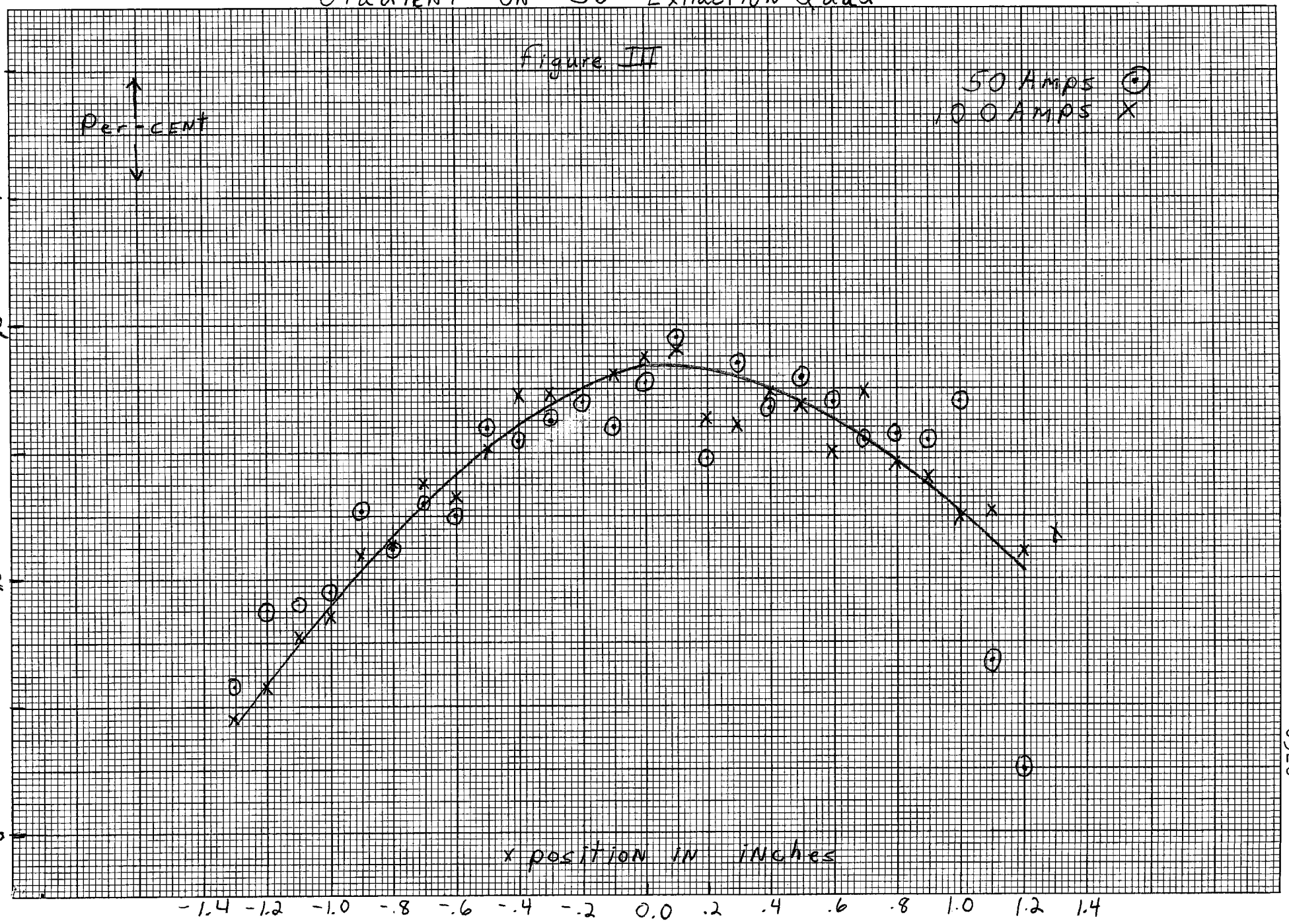


56 inch Extraction Quad



Gradient on 56" Extraction Quad

Figure III



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